Tuning of the spontaneous emission of two-dimensional photonic crystal microcavities by changing the slab thickness

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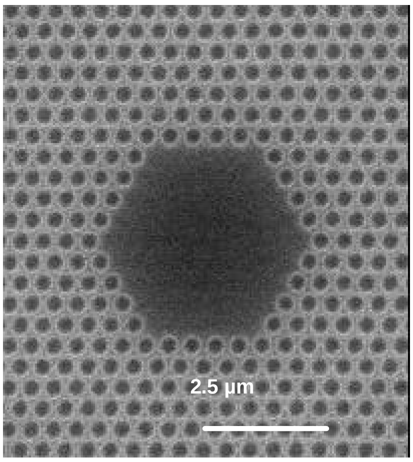
We have found a blue-shift in the cavity modes confined in two-dimensional photonic crystal microcavities when the thickness of the slab was varied uniformly by accurate dry etching. The shifts in the wavelength of the cavity modes were around 1.6 nanometers towards shorter wavelengths per nanometer of reduction in the thickness of the slab. Three-dimensional plane wave expansion (PWE) calculations showed that the observed shifts are inside the calculated photonic bandgap of the structures. The variation in the energy position of the peaks with the thickness has been analysed by three-dimensional finite difference time domain (FDTD). This tuning of the emission wavelength with the change in the thickness slab shows the important effect of the third dimension in photonic crystal cavities made out of semiconductor slabs and it can be applied to the fine tuning of photonic crystal lasers.



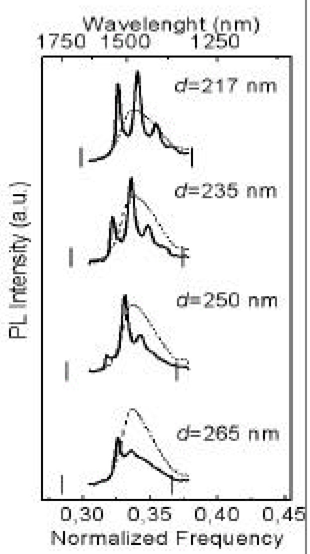


Fig.1.(a) Scanning electron microscopy image of the fabricated H5 cavities. (b) Photoluminescence spectra of the H5 microcavity as the thickness of the slab *d* is decreased (solid line). The spectra of an unpatterned region in the vicinity is shown also (segmented line). Straight lines on each of the spectra mark the position of the photonic bandgap calculated by three dimensional PWE method.